PRECAST CONCRETE VENEER PANEL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION(S)

None.

BACKGROUND OF THE INVENTION

The present invention relates to a veneer system for attachment to an interior or exterior wall. In particular, the present invention relates to concrete veneer panels which can be placed next to one another to form a wall facade which resembles a wall made from stones.

For a variety of applications, it is desired to create a wall or other structure from stone. Because each stone is unique, the stone wall has a highly pleasing appearance due to the variation in the stones used and the random pattern in which the stones are placed. However, building such a wall using either natural or cut stones is not always a practical option. Constructing a wall made of stone is often very expensive, labor intensive, and requires highly skilled laborers. In addition, specialized equipment and tools may be required.

As an alternative, a variety of simulated stone wall products have been developed which allow a user to make a wall which resembles one made from actual stone, but which in fact is made from a different material, such as concrete. One type of simulated stone wall is made using poured concrete. Such "pour in place" walls are made using a system of forms and form liners placed inside a concrete form. The form liners are created with a reverse impression of a random pattern of stones and mortar. Once the concrete is poured into the form, it is allowed to harden. After the concrete material hardens, the forms and form liners are removed to reveal a simulated stone wall.

In a pour in place application, problems arise in making the wall so that the finished product looks natural. It is particularly difficult to make the wall so that the finished product resembles a random pattern of unique stones. In poured in place applications, a more random pattern can be achieved by increasing the number form liners used in the form, with each form liner having a unique pattern of stones. However, in an effort to reduce cost, it is desirable that the number of form liners required to achieve a random pattern of unique stones be kept small.

In addition, each time two form liners are placed adjacent each other, a seam is formed in the resulting concrete wall. When the seams are visible in the wall, the resulting effect detracts greatly from the attempt to create a realistic simulated stone wall. To avoid a wall where the seams are readily visible, the seams must be properly masked. One method of masking the location of the seams between form liners is by designing the form liners to ensure the seams occur at mortar regions, rather than through a stone. Another method of masking the location of seams between form liners is by performing a finishing operation after the form liners are removed to smooth out the location of the seams, particularly when a seam occurs through the front surface of a simulated stone.

In an effort to reduce the number of form liners required to achieve a random pattern of unique stones, form liner systems have been developed which focus on varying the outer shape of the form liner. Rather than making the form liner in a rectangular shape, the shape of the form liner is varied along its vertical sides so that adjacent form liners fit together in a "puzzle piece" pattern. The non-rectangular form liners not only help to mask the repetition in the wall, but also serve to better hide the joints between the form liners. To further increase the ability to minimize the number of form liners used while making the resulting wall appear to have a random pattern of unique stones, some form liner systems are designed with a shape which allows the form liner to be placed next to an adjacent form liner in either a right side up orientation, or in an upside down orientation.

In addition to pour in place applications making use of form liners, it is also possible to precast sections of walls, wherein each precast piece has a surface shaped to resemble one or more natural or cut stones. Precast systems are created by casting the wall sections at a remote location, and moving the precast wall sections to the work site. At the construction site, the pre-cast wall sections are then placed together, and connected in a manner which results in the formation of a simulated stone wall. Just as it is difficult to ensure a poured in place wall

appears to have a random pattern of unique stones, it is difficult to ensure that pre-cast wall sections result in the desired random pattern. At the same time, to reduce the cost of manufacturing the pre-cast wall sections, it is desirable to reduce the number of precast sections which are required to form a wall that has a random pattern.

Pre-cast systems differ greatly from a pour in place system. Specifically, pre-cast blocks may require special equipment to move the blocks and to place them in position. Further, not all applications are appropriate for pour in place concrete, leaving precast systems as the more appropriate choice.

A third product may likewise be used to form a wall having a simulated stone surface. It is possible to use a veneer system, comprising a thin material which can then be attached to a wall surface, similar to exterior siding or interior paneling. The veneer panels may be formed to have a simulated stone surface, so that once the veneer system is attached, the wall appears to be made of stone. However, many of these veneer systems, particularly those made of vinyl products, are not realistic in texture or feel. In addition, the same problems arise in the inability to create a random pattern of unique stones using a minimum number of veneer panels. Veneer systems are particularly susceptible to "paneling out", wherein it becomes obvious that the pattern is repeating and non-random.

Concrete is a particularly suitable material for building simulated stone walls because it results in a more realistic texture and feel, and resembles stone more than other types of building materials. However, forming a veener system using concrete has been impractical to date. In particular, concrete veneers may be thick, making them heavy and unwieldly and difficult to install. In addition, when made thin enough to be more practical, the concrete may crack or break very easily, such as during shipping or during the installation process.

A further difficulty in forming a simulated stone wall is ensuring that while the number of form liners, precast, or veneer pieces is reduced, the

observer of the finished wall is not able to pick out certain stones because they are so unique in their surface texture. Every stone found in nature is unique. A repeating shape or pattern will be more noticeable to the human eye if the pattern contains a rock or stone which has a very distinctive shape or surface texture. Therefore, in order to construct a wall that appears to be made of stone, it is desirable to minimize the number of repeated stones and to arrange them such that there are no patterns easily detected to the human eye. Further, it is desired to form each stone in a manner which reduces its distinctiveness relative to the other stones, to make it more difficult for the human eye to pick out the stone as it repeats in the wall.

BRIEF SUMMARY OF THE INVENTION

The present invention relates to a system of concrete veneer panels placed together to form a wall surface which appears to have a random pattern unique stones. Each of the veneer panels is multi-sided, and is shaped to allow the panels to easily interconnect vertically and horizontally with other panels. The shape of the veneer panels also allows for a unique pattern of stones to be present on the front surface, and better masks the location of any joints or seams which occur where adjacent panels meet. The ease with which the panels interconnect also makes it easy to install the panels to obtain a realistic wall having a random pattern, without requiring the use of an installation plan or diagram.

To allow the veneer panels to be installed on a wall surface, the panels have a back mounting surface. The front surface of the veneer panels comprises a pattern of simulated stones surrounded by simulated mortar regions. Preferably, the veneer patterns are formed of a fiber reinforced concrete (FRC). Making the veneer panels of FRC results in the panels having a thickness which allows the panels to be hung using standard mounting methods, such as sheet rock screws. Using FRC also results in the veneer panels having the necessary strength and robustness to survive shipping and to resist cracking during installation. Further, FRC is a highly durable material which is suitable for use in exterior settings, as well as interior settings.

The present invention also comprises a veneer panel system. The veneer panels system may comprise two or more panels, which each panel having an identically shaped perimeter, but having a unique pattern of stones on its front surface. The veneer panel system may further comprise caulk for sealing any joints between the panels, and for masking such joints. The veneer panel system may also include colorants for coloring the veneer panels to make the stones appear realistic. Alternatively, the veneer panel system may be pre-colored to resemble stones.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A-1C are front views of three concrete veneer panels having different patterns of cut stones.

Fig. 2 is an exploded front view of two concrete veneer panels illustrating how the panels horizontally interconnect.

Fig. 3 is a diagrammatic view illustrating the placement of concrete veneer panels to form a wall.

Fig. 4 is a first diagrammatic view illustrating how rows of concrete veneer panels vertically interconnect.

Figure 5 is a second diagrammatic view illustrating how rows of concrete veneer panels vertically interconnect.

Fig. 6 is a front view of a wall formed from a plurality of concrete veneer panels.

Fig. 7 is a cross-sectional view of a concrete veneer panel.

Figs. 8A-8B illustrate an alternative concrete veneer panel having a pattern of natural stones.

Fig. 9 is a diagrammatic view illustrating the placement of the concrete veneer panels of Figures 8A-8B to form the wall.

Fig. 10 is a front plan view of a wall formed of the concrete veneer panels of Figs. 8A-8B.

Figs. 11A-11B illustrate concrete veneer panels having an alternate pattern.

Fig. 12 is a diagrammatic view of the placement of the panels of Figures 11A-11B to create a wall.

Fig. 13 is a view of a wall formed by the concrete veneer panels of Figs. 11A-11B.

Figs. 14A-14B illustrate concrete veneer panels having yet another alternative pattern.

Fig. 15 is a diagrammatic view of the placement of the panels of Figures 14A-14B to create a wall.

Fig. 16 is a view of a wall formed by the concrete veneer panels of Figs. 14A-14B.

Figs. 17A-17D illustrate a concrete veneer panel system having panels with an alternative shape.

Fig. 18 is a diagrammatic view of the placement of the panels of Figures 17A-17D to create a wall.

Fig. 19 is a view of a wall formed by the concrete veneer panels of Figs. 17A-17D.

Figs. 20A-20C illustrate a concrete veneer panel system having panels with yet another alternative shape.

Fig. 21 is a diagrammatic view of the placement of the panels of Figs. 20A-20C to create a wall.

Fig. 22 is a view of a wall formed by the concrete veneer panels of Figs. 20A-20C.

DETAILED DESCRIPTION

Figures 1A-1C illustrate a first concrete veneer panel 10, a second concrete veneer panel 12, and a third concrete veneer panel 14. The concrete veneer panels 10, 12, 14 comprise a plurality of simulated cut stone regions 16 surrounded by simulated mortar regions 18. Each concrete veneer panel 10, 12, 14 comprises twenty sides and has an axis of symmetry 20 which results in the concrete veneer panels 10, 12, 14 having "mirror" symmetry. In addition to the mortar regions 18, the outer edges of the panels 10, 12, 14 comprises a half mortar region 22. The half mortar region 22 is necessary so that when to panels 10, 12, 14 are placed adjacent each other, the two half mortar regions 22 combine to form a single mortar region equal to the simulated mortar regions 18.

The veneer panels 10, 12, 14 are designed for application to a wall surface to create a wall which appears to be made of cut stone. To create the wall surface, several veneer panels 10, 12, 14 are attached to a wall surface to create a simulated cut stone wall having a unique random pattern. To increase the realism of the resulting wall, the veneer panels 10, 12, 14 are designed to interconnect in a manner which ensures the resulting pattern of stone regions 16 and mortar regions 18 appears random and which masks the location of the joints where the veneer panels 10, 12, 14 are interconnected.

For the sake of clarity, the shape of the veneer panels 10, 12, 14 refers to the shape of the sides, while the pattern of the veneer panels 10, 12, 14 refers to the arrangement of simulated stone regions 16 and mortar regions 18 of the form liner 10, 12, 14. Each of the concrete veneer panels 10, 12, 14 have the same shape, but have different patterns of simulated stone regions 16 and mortar regions 18.

In designing the pattern of cut stone regions 16 for the concrete veneer panels 10, 12, 14, it is important to size and scale the cut stone regions 16 in a manner which allows the cut stone regions 16 to fit the shape of the concrete

veneer panel 10, 12, 14. As such, the cut stone regions 16 are designed so that the stone regions 16 remain whole, even at the outside edges of the form liners 10, 12, 14. In other words, none of the stone regions 16 are split at any of the outer edges, but rather fit into the outer shape of the concrete veneer panel 10, 12, 14 so that each stone is surrounded by a mortar region 18 or half mortar region 22.

In determining the pattern of stone regions 16 for the veneer panels 10, 12, 14, it is desired to create patterns on each panel 10, 12, 14 which while unique, remains of a similar size and scale. This is because if one of the stone regions 16 is much larger than most of the other stone regions 16, any time that concrete veneer panel 10, 12, 14 is used on the wall, the repetition of that distinctive stone region 16 becomes more apparent. Such a result is undesirable because it makes clear the wall is not made from real cut stones, but rather is a simulated stone wall. Alternatively, in patterns which require stone shapes which have a greater variety of size and shape, more veneer panels may be needed in the finished wall product to ensure the wall retains a random appearance.

In addition to their size, the texture of the stone regions 16 and their depth must be kept within a similar range to prevent one of the stones from being so different, it is easily picked out in all the panels, and in all the locations it appears in the finished wall.

Though each side of the veneer panels 10, 12, 14 intersects the adjacent side at a right angle, the concrete veneer panels 10, 12, 14 are not so limited. The concrete veneer panels 10, 12, 14 may have more or fewer sides, and may have sides which are linear (as shown) or nonlinear, and which intersect each other at greater than or less than ninety degrees.

The veneer panels 10, 12, 14 are shaped so that the veneer panels 10, 12, 14 easily interconnect with each other. Figure 2 is an exploded diagrammatic view of a first concrete veneer panel 30 and a second concrete veneer panel 32. The panels 30, 32 are arranged to illustrate how two panels may be connected

horizontally next to each other. To do so, each panel 30, 32 has a first side interconnection region 34 and a second side interconnection region 36. Due to the mirror symmetry of the panels 30, 32, the first panel 30 connects to the second panel 32 by rotating the second panel 180 degrees relative to the first panel 30. This allows the second panel 32 to interconnect with the first panel 30 at the second side interconnection regions 36 of each panel 30, 32.

The first and second concrete veneer panels 30, 32 are also designed so that when two panels are interconnected, other panels likewise interconnect both along a horizontal configuration and a vertical configuration. To allow the panels 30, 32 to connect vertically, the panels 30, 32, are shaped to have a single tab 38 and a double tab 40. As viewed in Figure 2, the single tab 38 is on the bottom of the first panel 30, and is on the top of the second panel 32. Similarly, as viewed in Figure 3, the double tabs 40 are on the top of the first panel 30, and are on the bottom of the second panel 32.

In addition to the single tab 38 and double tabs 40 of the panels 30, 32, each panel has a first side 42 and a second side 44 adjacent the side interconnection regions 34, 36. The length of the first side 42 combined with the length of the second side 44 is about equal to the lengths of the single and double tabs 38, 40. The relationship of the first and second sides 42, 44 also allows the panels 30, 32 to be connected vertically. To further simplify the ability to interconnect the panels vertically, it may be necessary to dimension the single tab 38 so that it is about 1/8 to about 1/4 inch shorter in length than the combined lengths of the first and second sides 42, 44.

Each panel 30, 32 likewise has a cut line 46. The cut line 46 indicates a location where the panels 30, 32 may be split to create a straight line surface of the panel 30, 32 which does not have a tab or slot. The cut line 46 is useful for placing a row of panels 30, 32 in an application which requires a straight surface, such as when placing the panels 30, 32 along the bottom or top of a wall.

Figures 3-5 further illustrate the manner in which the concrete veneer panels can be placed next to each other to form a wall surface which appears to be made of cut stone. Figure 3 is a diagrammatic view showing first concrete veneer panels 50, second concrete veneer panels 52, and third concrete veneer panels 54 arranged for placement against a wall surface. Each of the veneer panels 50, 52, 54 is interlocked with adjacent concrete veneer panels 50, 52, 54 both horizontally and vertically.

Because each veneer panel 50, 52, 54 has the same outside shape, but may have a different stone pattern, assembling the wall system so that a random stone wall pattern is created is greatly simplified. Installation of the panels 50, 52, 54 is also greatly simplified due to the horizontal and vertical interconnectability of the panels 50, 52, 54. Because all of the concrete veneer panels 50, 52, 54 are the same shape and easily interlock with each other, once a first panel 50, 52, 54 is placed, a second panel horizontally connects to the first panel in only one way.

In addition to the ease with which the panels 50, 52, 54 interconnect horizontally, the panels 50, 52, 54 are easily modified to start the bottom of the wall or to finish the top of the wall. To do so, the panels 50, 52, 54 have been split at a cut line 56 which separates the panels 50, 52, 54 into portions which have a straight surface for placing at the bottom of the wall. This feature can also result in less scrap, because cutting a panel 50, 52, 54 at the cut line 56 results in two halves which can both be used along the surface which requires a straight line.

Fig. 4 is an exploded diagrammatic view of a plurality of concrete veneer panels 60 illustrating one manner in which the veneer panels 60 interconnect vertically. The veneer panels 60 arranged in a plurality of rows 62. When arranged in rows 62, the concrete veneer panels 60 connect horizontally by rotating one panel 180 degrees relative to another, and interconnecting the panels 60 at a connection region 64. When connected in this way, each row 62 has a non-linear top and bottom, with each row 62 comprising a series of tabs 66 and slots 68 on the top and

bottom of the row 62. The tabs 66 and slots 68 are sized so that the tabs 66 of the adjacent row 62 fit into the slots 68 of the adjacent row 62.

As described above, the slots 68 comprise two sides 70, 72 which are about equal in length to the length of the tabs 66. To make it easier to interconnect the veneer panels 60, the tabs 66 may be slightly shorter than the length of the slots 68. In Figure 4, the rows 62 interconnect to the adjacent row 62 so that each veneer panel 60 is offset from the veneer panel 60 directly below it.

Figure 5 is an exploded diagrammatic view of an alternate vertical interconnection design. Shown in Figure 5 are a plurality of veneer panels 80 interconnected horizontally as described above to create rows 82. Each row 82 comprises a non-linear top and bottom, made of tabs 84 and slots 86. Unlike the configuration shown in Figure 4, the rows 82 shown in Figure 5 interconnect vertically so that each panel 80 is not offset relative to the panels in the adjacent row. Instead, each panel 80 is oriented in the same location as the panel directly below it.

The mirror symmetry and size of the veneer panels 60, 80 allow the unique ability to interconnect the panels 60 vertically as shown in Figures 4 and 5. The non-linear top and bottom created by the rows 62, 82 helps to mask the connection joints of the veneer panels 60, 80. The non-linear top and bottom of the rows 62, 82 further serves to mask the fact that a limited number of concrete veneer panels 60, 80 is used to form a random pattern of cut stones in the finished wall.

Figure 6 is a front view of a wall 88 made using the concrete veneer panels 10, 12, 14 illustrated in Figure 1. The concrete veneer panels 10, 12, 14 are arranged as shown diagrammatically in Figure 3. When interconnected as illustrated in Figure 3, the resulting wall 88 appears to have a random pattern of stone regions 16 and mortar regions 18.

Further, it becomes nearly impossible to determine the location of the individual panels 10, 12, 14. Because each panel 10, 12, 14 has a half mortar

region 22 around its perimeter, when the panels 10, 12, 14 are interconnected, all mortar regions appear to be whole mortar regions 18, making it difficult to determine the location where two panels are connected. Further, ensuring the stone regions 16 in each panel 10, 12, 14 are kept whole likewise reduces the ability to determine a location of where two panels 10, 12, 14 interconnect. Finally, designing the pattern of the panels 10, 12, 14 so that the stone regions 16 have a similar scale prevents any one stone region 16 from being easily identified, so that it becomes obvious that the wall 88 is made of a limited number of panels 10, 12, 14.

A major reason the wall 88 obtains a realistic and random pattern of cut stones is due to the manner in which the panels 10, 12, 14 interconnect both horizontally and vertically. Ensuring both horizontal and vertical interconnections which are non-linear, non straight lines, greatly masks the fact that the wall 88 is formed of veneer panels 10, 12, 14, rather than actual cut stones.

To further make the wall 88 appear to be a realistic stone wall, the stone regions 16 may have a colorant applied to them. The colorant may be integrated into the manufacturing process of the panels 10, 12, 14, or may be applied after the panels 10, 12, 14 have been installed. Applying colorant to concrete to create a realistic stone surface is known in the art, and any suitable method may be used. To further mask the location of the joints between adjacent panels 10, 12, 14, caulk may be applied to the joints. To make the wall as realistic as possible, the caulk may be sanded caulk, which is known in the art.

The wall 88 retains a realistic appearance, even though a limited number of patterns were used to create the veneer panels 10, 12, 14. Though Figures 1 through 5 illustrate a wall 88 created using only three different panel patterns, the invention is not so limited. As few as two panels having different patterns may be used in the same manner to obtain a random looking wall surface. Further, in situations which require stone regions which have a greater variety in

size or shape, more panels having different patterns may be necessary. As such, up to four, six, or eight panel patterns may be used in obtaining the desired random pattern of unique stones on a wall surface. However, reducing the number of panels with different patterns not only reduces the cost, but also reduces the complexity of installing the panels on a wall surface.

Fig. 7 is a cross-sectional view of a concrete veneer panel 90. The concrete veneer panel 90 comprising a connection mechanism 92, a front surface contour 94 and a reverse surface contour 96. The front surface contour 94 comprises mortar regions 98 as well as stone surface regions 100. The concrete veneer panel further has a thickness 102.

The connection mechanism 92 may be any suitable connection mechanism for attaching the concrete veneer panel 90 to a wall surface. For instance, the connection mechanism 92 may comprise a countersunk hole suitable for inserting a mechanism such as a screw, bolt, or nail. For instance, the panel 90 may be connected to a wall surface using a standard sheet rock screw. In such an embodiment, the veneer panel 90 is installed using a screw inserted into the countersunk hole to connect it to a wall surface. In addition, the connection mechanism may comprise a compression limiter to prevent the screw from damaging the concrete veneer panel when it is hung in place.

Alternately, the connection mechanism 92 may comprise a cast-in threaded insert which provides for the attachment of the veneer panel 90 to the wall surface. An integrated cast-in threaded insert may further increase the ease of installing the veneer panel 90. Finally, the connection mechanism may comprise a location for applying an adhesive for holding the veneer panel 90 against a wall surface.

The location of the connection mechanism 92 on the veneer panel may vary based on the particular application. For instance, the connection mechanisms may be placed at locations on the front of the panel 90 which will

correspond to the locations of the wall studs to which the panel will be connected. Further, while the veneer panel 90 is shown with a connection mechanism 92, the panel is not so limited. It may be possible to hang the panel 90 simply by drilling a hole through the panel 90 and screwing the panel in place. Further, it may be possible to hang the panel 90 without first drilling a hole, but rather by simply screwing the panel 90 in place. As such, installing the concrete veneer panel 90 can be done using standard tools, such as a drill or power screwdriver.

The veneer panel 90 is configured for application to a wide variety of wall surfaces. For instance, the veneer panel 90 may be attached to metal or wood studs, plywood wall surfaces, sheet-rock wall surfaces, or even concrete wall surfaces. Further, the veneer panel 90 may be suitable for either interior or exterior applications.

The front surface 94 of the concrete veneer panel 90 comprises contours 100 which resemble a natural stone surface, as well as mortar regions 98 which resemble the mortar between the stones. The thickness 102 of the concrete veneer panel may vary and may be of any suitable thickness which results in a suitable strength of material, visual appearance to make it resemble natural stone, and yet which remains light enough so that the panels 90 are easily handled and installed. More specifically, the thickness of the panel may be in the range of about ½" thick to about 3/4" thick.

The back surface 96 is a reverse contour of the front surface 94. The back surface 96 is a result of forming the concrete veneer panel 90 using a molding process. To create the panel 90, concrete material, such as FRC, is sprayed onto a mold member having the desired stone and mortar contours. In making the panel 90, the concrete material is sprayed on the mold member surface in a manner which ensures the desired thickness of the resulting concrete veneer panel 90. As such, the back surface of the panel 96 may not be flat but may rather be a reverse image of the front contour 94. The depth of relief of the stone regions 100 compared to

the mortar regions 98 is greatly variable, and may vary based on the desired type of stone surface pattern.

When attaching the concrete veneer panel 90 to a wall surface, it is desirable for the panel 90 to fit against the wall surface as flat as possible. As such, it is desirable to form the panels 90 in a manner which ensures all the panels 90 have about the same thickness. Having a uniform thickness of each panel 90 also ensures the resulting wall surface appears more uniform, and thus more realistic in appearance.

In addition, when placing the panels 90 against a wall surface, the panels must fit flush to the wall to avoid the need to use shims or other installation methods. As such, the concrete veneer panel 90 may be configured with a back mounting surface, such as a perimeter region 104 which forms an outer edge around the veneer panel 90. The perimeter region 104 is meant to fit flat against any wall backing material to which the panel 90 is attached. This region 104 may run the entire perimeter of the concrete veneer panel 90. Alternatively, the veneer panel 90 may be equipped with backing regions 106 which extend about the depth of the reverse contours and provide a location of the panel 90 which can be placed flush against any wall backing material.

Each concrete veneer panel 90 is preferably made of a concrete material. One suitable material is fiber reinforced concrete (FRC). A FRC material is preferable due to its high strength and ability to be used in a very thin application. Another advantage of forming the panel 90 of FRC is that the panel is easy to cut to size and shape using standard equipment, such as a saw or grinder. Forming the concrete veneer panels of fiber reinforced concrete also has the advantage of obtaining an easily repeatable desired thickness of the panel 90. Further, fiber reinforced concrete allows the panels 90 to be made very thin, such as in a range of thickness of about ½" thick to about 3/4" thick.

Making the panels 90 this thin likewise results in the panels 90 being light and easy for a single person to move and handle during installation. However, when forming the veneer panels 90, the panels 90 must be of a thickness which ensures the panels 90 are strong and robust enough for a variety of applications, and ensures they are sturdy enough to survive shipping and installation without becoming cracked or otherwise damaged.

In determining the type of FRC to be used, the FRC is preferably a type of concrete which is easy to spray onto a mold. When sprayed onto a mold, the FRC must be of a consistency which does not flow too easily, but rather remains in the location of the stone contour regions and the mortar regions. Further, each stone contour region will have a surface texture which increases the realism of the stone. The FRC used must also be capable of obtaining the desired surface texture.

Finally, FRC is a preferred material because its shrink rate is small and controllable, which increases the ability to make the panels 90 so that they have the desired tolerance in both thickness, and height and width dimensions. The size of the concrete veneer panels 10, 12, 14 may vary. However, a preferred height H and width W is about 2' x 6'.

Thus, the concrete veneer panel system is suited for a wide variety of applications. The concrete veneer panel system does not require specialized tools or equipment, yet results in a very realistic wall surface. Further, the system provides for a high quality and aesthetically pleasing wall which is easy to install, and which is much less expensive than a real stone wall.

Figures 8-16 illustrate alternate concrete veneer panel systems which may be used to form simulated stone walls having a variety of stone patterns. Figures 8A and 8B illustrate a first concrete veneer panel 110 and a second concrete veneer panel 112. Each concrete veneer panel 110, 112 comprises simulated stone

regions 114 and simulated mortar regions 116. Further, each veneer panel 110, 112 comprises a half mortar region 118 around the outer edge of the panel 110, 112.

Though both concrete veneer panels 110, 112, have the same shape, each panel 110, 112 has a different pattern of stones 114 and mortar regions 116. Further, the stone regions 114 are simulated natural stones, so that the pattern in each veneer panel 110, 112 may be referred to as a "field stone" pattern. For each panel 110, 112, the stones 114 are arranged in such a manner that they appear randomly oriented in each panel 110, 112. Similarly, neither panel 110, 112 contains any stones that are split or otherwise cut by the outside perimeter of the veneer panel 110, 112. Rather, all of the stones 114 remain whole, and remain surrounded by a portion of the mortar region 116 or half mortar region 118.

The concrete veneer panels of 110, 112 can be placed next to each other, using the system similar to that described above with reference to Figs. 3-5 to obtain a wall surface having a simulated random field stone pattern. Figure 9 is a front diagrammatic view illustrating the manner in which the first and second concrete veneer panels 110, 112 of Figures 8A-8B may be arranged to create a wall surface. Each concrete veneer panel 110, 112 interconnects with an adjacent panel 110, 112 both horizontally and vertically. To interconnect horizontally, the panels 110, 112 interconnect by rotating one panel 110, 112 180 degrees relative to another panel 110, 112. The panels 110, 112 also interconnect vertically in a manner described above with reference to Figure 4.

To assemble the wall 120, the concrete veneer panels 110, 112 are shaped and sized so that the wall can be assembled virtually error-free and with great speed. This is because once the first panel 110, 112 is put in place, all adjacent panels interlock in only one orientation. Similarly, the adjacent panels may be placed at random, and due to the rotation required, the resulting wall will have a random pattern. Thus, no master plan is required for illustrating the placement of each concrete veneer panel relative to the other.

Figure 10 is a front view of a wall 120 made using the concrete veneer panels 110, 112 illustrated in Figures 8A-8B. The concrete veneer panels 110, 112 are arranged as shown diagrammatically in Figure 9. When interconnected as illustrated in Figure 9, the resulting wall 120 appears to have a random pattern of stone regions 114 and mortar regions 116. The wall 120 retains a realistic appearance, even though only two patterns were used to create the veneer panels 110, 112.

Because each panel 110, 112 has a half mortar region 118 around its perimeter, when the panels 110, 112 are interconnected, all mortar regions appear to be whole mortar regions 116, making it difficult to determine the location where two panels are connected. Further, ensuring the stone regions 114 in each panel 110, 112, are kept whole likewise reduces the ability to determine a location of where two panels 110, 112 interconnect. Finally, designing the pattern of the panels 110, 112 so that the stone regions 114 have a similar scale prevents any one stone region 114 from being easily identified, so that it becomes obvious that the wall 120 is made of only two panels 110, 112.

Further, as described above, it becomes nearly impossible to determine the location of the individual panels 110, 112 due to the horizontal and vertical interconnections of the panels 110, 112. Ensuring both horizontal and vertical interconnections which are non-linear, non straight lines, greatly masks the fact that the wall 120 is formed of veneer panels 110, 112, rather than actual cut stones.

Figures 11A through 13 illustrate yet another embodiment of a concrete veneer panel system according to the present invention. Figures 11A-11B illustrate a first concrete veneer panel 130 and a second concrete veneer panel 132. Each panel 130, 132 comprises different pattern of stone regions 134 and mortar regions 136. Further, each panel 130, 132 comprises a half mortar region 138

which surrounds the perimeter of each panel 130, 132. The pattern shown in the veneer panels 130, 132 is a cut stone pattern often referred to as an "ashlar" pattern.

Figure 12 illustrates one manner in which the concrete veneer panels 130, 132 may be arranged to form a wall surface. As described above with reference to Figures 3 and 9, the veneer panels 130, 132 interconnect both horizontally and vertically.

Figure 13 is a front view of a wall surface 140 created by arranging the concrete veneer panels 130, 132 of Figures 11A-11B in the manner shown in Figure 13. The resulting wall appears to have a random pattern of stone regions 134 and mortar regions 136. The wall 140 retains a realistic appearance, even though only two types of veneer panels 130, 132 with different patterns were used. The resulting wall 140 has the same benefits as described above with reference to Figures 6 and 10.

Figures 14A-14B show yet another alternate embodiment of a concrete veneer system. Figures 14A-14B illustrate a first concrete veneer panel 150 and a second concrete veneer panel 152. Each panel 150, 152 comprises different pattern of stone regions 154 and mortar regions 156. Further, each panel 150, 152 comprises a half mortar region 158 which surrounds the perimeter of each panel 150, 152. The pattern shown in the veneer panels 150, 152 is a natural stone pattern often referred to as an "dry stack" pattern. In dry stack walls, no mortar used to hold the stones in place. Thus, the mortar region 156 and half mortar region 158 of Figures 14A-14B refers not to mortar, but rather to the region between the stones necessary to create the illusion of a dry stack configuration of stones.

Figure 15 illustrates one manner in which the concrete veneer panels 150, 152 may be arranged to form a wall surface. As described above with reference to Figures 3, 9, and 12 the veneer panels 150, 152 interconnect both horizontally and vertically.

Figure 16 is a front view of a wall surface 160 created by arranging the concrete veneer panels 150, 152 of Figures 14A-14B in the manner shown in Figure 15. The resulting wall appears to have a random pattern of stone regions 154 and mortar regions 156. The wall 160 retains a realistic appearance, even though only two types of veneer panels 150, 152 with different patterns were used. The resulting wall 160 has the same benefits as described above with reference to Figures 6, 10, and 13.

Figures 17A-17D show an alternate embodiment of a concrete veneer panel having a different outer perimeter shape than those illustrated above. Shown in Figures 17A-17D are a first concrete veneer panel 200, a second concrete veneer panel 202, a third concrete veneer panel 204, and a fourth concrete veneer panel 206. The concrete veneer panels 200 through 206 each comprise 16 sides are symmetric about a center axis 208 (shown in Figs. 17A, 17C). Once again, the concrete panels 200 through 206 have a mirror symmetry.

The panels 200-206 are shaped so that the panels 200-206 easily interconnect with each other. As such, each panel 200-206 has side interconnection regions 210 which allow the concrete veneer panel 200-206 to be attached to an adjacent panel by rotating it 180 degrees. In addition to the side interconnection regions 210, each concrete veneer panel 200-206 comprises a top tab 212 and a bottom tab 214. Further, each concrete veneer panel 200-206 is designed so that the top sides 216 adjacent the connection regions 210 complement the bottom sides 218 adjacent the connection regions 210. In other words, the length of the top side 216 plus the bottom side 218 equals about the length of the top tabs 212 and bottom tabs 214.

Each concrete veneer panel 200-206 is formed of FRC as described above. Further, the panels 200-206 are designed to have a thickness similar to that described above. The width of the panels 200-206 is preferably about six feet while the height of the panels is preferably three feet. However, the veneer panels 200-

206 are not so limited in size and may be made of any size suitable for any application.

Each concrete veneer panel 200- 206 contains a pattern of simulated stone regions 220 surrounded by a mortar region 222. Each panel 200-206 further comprises a half mortar region 224 around the perimeter of the panel 200-206. The pattern of stones 220 and mortar 222 differs for each of the panels 200-206. The size and scale of the stone regions 220 of each panel 200-206 is designed to have many of the same features described above with reference to Figure 2. Further, the stone regions 220 are arranged so that each stone region 220 is surrounded by a mortar region 222 or half mortar region 224, and none of the stone regions 220 are split at the edges of the panels 200 - 206.

Figure 18 is a diagrammatic view illustrating the manner in which the veneer panels 200-206 may be arranged on a wall surface. The panels 200-206 are sized and shaped to allow easy interconnection of the panels 200-206 in both a horizontal and vertical direction. Similar to the panels illustrated in Figure 3, the veneer panels 200-206 interconnect horizontally at the side interconnection regions 210. Once connected horizontally, the panels 200-206 have a non-linear top and bottom surface comprising tabs 212, 214, and slots created where the top sides 216 of one panel meet the bottom sides 218 of the adjacent panel. The panels 200-206 interconnect vertically by the tabs 212, 214 interconnecting with the slots created by sides 216, 218.

To further ease the vertical interconnectability of the panels 200-206, the tabs 212, 214 may be slightly smaller in width than the slots created by the top and bottom sides 216, 218 adjacent the tabs 212, 214. Specifically, the length of the tabs 212, 214 may be about 1/2 to about 1/4 inches shorter than the length of the slots created by top and bottom sides 216, 218.

The shape of the panels 200-206 ensures the panels can be installed quickly and easily. Because the panels 200-206 are shaped so that, no map or

master plan is required when assembling the wall. Rather, the panels can be placed next to each other with little regard to which pattern of panel is used and the resulting wall will still have the desired random pattern of unique stones.

Figure 19 is a front view of a wall 230 formed using the concrete veneer panels 200-206 of Figures 17A-17D arranged as shown in Figure 18. When interconnected as shown in Figure 18, the resulting wall 230 appears to have a random pattern of stone regions 220 and mortar regions 222. Similar to the panels described above, once interconnected, it is almost impossible to determine the location of the separate veneer panels 200-206, such that the resulting wall 230 appears very realistic.

The natural appearance of the wall 230 is due in part to the half mortar region 224 around the perimeter of the panels 200-206. When the panels 200-206 are interconnected, all mortar regions 222 appear to be whole mortar regions, making it difficult to determine the location where two panels meet. Further, ensuring the stone regions 220 are kept whole likewise reduces the ability to determine a location where two panels 200-206 meet. Finally, the patterns of the panels 200-206 are designed to minimize the ability for one stone region 220 to be easily identifiable so that it becomes obvious the wall 230 is made of a limited number of panels 200-206.

Another reason the wall 230 obtains a realistic and random pattern of unique stones is the manner in which the panels 200-206 interconnect. Having both vertical and horizontal interconnections further serves to mask the location of the individual veneer panels 200-206. Though shown as using four panels having different patterns of stones, the invention is not so limited. It may be possible to use fewer panels, such as two panels with different patterns, to create a wall having a random pattern of unique stones. Or, it may be possible to use additional panels to create the wall.

Figures 20A-20C illustrate yet another embodiment of a concrete veneer panel system for use in making a wall surface which has a random pattern of unique stones. Figures 20A-20C shows a first concrete veneer panel 240, a second concrete veneer panel 242, and a third concrete veneer panel 244. Each panel 240-244 comprises a plurality of simulated stone regions 246 surrounded by simulated mortar regions 248. Further, each panel 240-244 has a half mortar region 250 around the perimeter of the veneer panel 240-244. While each panel 240-244 has the same shape, the pattern of stone regions 254 in each panel 240-244 is different.

Each of the panels 240-244 comprise sixteen sides and are sized and shaped to allow them to be interconnected with each other. Unlike the previous concrete veneer panels, the concrete veneer panels 240-244 do not have an axis of symmetry about which they have mirror symmetry. Each panel 240-244 has side interconnection regions 252. Each veneer panel 240-244 also comprises a top tab 254 and a bottom tab 256. Once again, adjacent the top and bottom tabs 254, 256 are a first side 258, and second side 260 which complement each other. When two panels 240-244 are interconnected, the first side 258 of one panel 240, 242, 244 combines with the second side 260 of an adjacent panel to create a slot having a length that is about equal to the length of the top and bottom tabs 254, 256.

Figure 21 is a diagrammatic view illustrating how the panels 240-244 of Figures 20A-20C can be arranged on a wall surface. The panels 240-244 interconnect both horizontally and vertically. More specifically, the veneer panels 240-244 are shaped so that once a first panel 240-244 is put in place, a second panel 240-244 can be placed adjacent the first panel by either rotating the second panel 180 degrees relative to the first, or by simply placing it adjacent the first panel.

Once connected horizontally, the panels 240-244 have a non-linear top and bottom surface comprising tabs 254, 256 and slots created where the complimentary sides 258, 260 of adjacent panels 240-244 meet. The panels 240-

244 interconnect vertically by the tabs 254, 256 interconnecting with the slots created by complementary sides 258, 260.

To further ease the vertical interconnectability of the panels 240-244, the tabs 254, 256 may be slightly smaller in width than the slots created by the complementary sides 258, 260. Specifically, the length of the tabs 254, 256 may be about 1/2 to about 1/4 inches shorter than the length of the slots created by complementary sides 258, 260.

Figure 22 is a front view of a wall 262 created by arranging the panels 240-244 of Figures 20A-20C as shown in Figure 21. When interconnected as shown in Figure 21, the resulting wall 262 appears to have a random pattern of stone regions 246 and mortar regions 248. Similar to the panels described above, once interconnected, it is almost impossible to determine the location of the separate veneer panels 240-244, such that the resulting wall 262 appears very realistic.

Other than the increased flexibility of placing the panels 240-244, the panel system of Figures 20A-22 has many of the same features of the previously described veneer panels systems. Specifically, the natural appearance of the wall 260 is due in part to the half mortar region 250 around the perimeter of the panels 240-244. When the panels 240-244 are interconnected, all mortar regions 248 appear to be whole mortar regions, making it difficult to determine the location where two panels meet. Further, the stone regions 246 are kept whole to reduce the ability to determine a location where two panels 240-244 meet. Finally, the patterns of the panels 240-244 are designed to minimize the ability for one stone region 246 to be easily identifiable so that it becomes obvious the wall 260 is made of a limited number of panels 240-244.

Another reason the wall 240 obtains a realistic and random pattern of unique stones is the manner in which the panels 240-244 interconnect. Having both vertical and horizontal interconnections further serves to mask the location of

the individual veneer panels 240-244. Though shown as using three panels having different patterns of stones, the invention is not so limited. It may be possible to use fewer panels, such as two panels with different patterns, to create a wall having a random pattern of unique stones. Or, it may be possible to use additional panels to create the wall.

Given the manner in which the panels 240-244 interconnect horizontally in two ways, either directly or by rotating 180 degrees, the concrete veneer panel system illustrated in Figure 21 is even more flexible in the way that it can be assembled than those previously illustrated. Because each panel can be placed either right side up or rotated 180 degrees, the possible iterations of the concrete veneer panel system is increased without requiring additional panels with different patterns. In addition, installation of the panels on a wall surface is greatly simplified. Regardless of whether or not the user has a master plan for placing the panels, the panels can be placed randomly next to each other and the resulting wall pattern will show a random pattern of stones.

All of the concrete veneer panel systems described above have the advantage being easily installed to create a very realistic looking stone wall having a random pattern of stones. Due to the innovative design of the concrete veneer panels, the panels can be installed on a wall surface in a virtually error-free manner and with great speed. This is because the shape of the panels eases the manner in which they are interconnected to cover the wall surface. Once a first panel is put in place, all adjacent panels interlock in only one orientation. Similarly, the adjacent panels may be placed at random, with the installer choosing any panel regardless of its pattern, and due to the horizontal and vertical interconnectability of the panels, the resulting wall will have a random pattern. Thus, no master plan or complicated installation diagram is required for illustrating the placement of each concrete veneer panel relative to the other.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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